# THE SPATIAL PATTERN OF KIBS AND THEIR RELATIONS WITH THE TERRITORIAL DEVELOPMENT IN ROMANIA

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**Abstract**

The development of Knowledge Intensive Business Services (KIBS) in recent decades can be interpreted as one of the major factors in a transition from an industrial economy into a knowledge-based one. It is an increasingly common belief that KIBS not only perform innovation activities in the service of the manufacturing sector, but they are also "bridges of knowledge" or "innovation bridges", connecting the manufacturing sector, science and customers. The research questions were numerous. This paper attempts to reveal the existence of any relationship indicators, with special regards to the tourism indices and the KIBS related variables and how their position among different development indicators can be determined. It also explores whether there is any territorial difference or disparity within the counties of Romania. The results show that the KIBS related activities represent significant spatial concentration in the urban centres, especially in Bucharest. The concentration of KIBS-related local units were significant in several Romanian counties: Braşov, Cluj, Constanţa, Ilfov, Sibiu and Timiş (these counties and Bucharest contain almost 60 percent of the KIBS-related local units in Romania in 2013) and this territorial pattern is completely overlapped by the results of the multivariate cluster analysis. Different factors of KIBS are analysed by factor analysis, setting the KIBS-related indicator into the first component named 'Economic prosperity' with different development and infrastructural indicators.

The research also reveals a strong correlation among the development indicators that predicts the significant spatial disparities from the respect of KIBS. The method used and the results produced could be useful for experts and decision makers in the field of economics and regional development.

**Keywords:** KIBS, economic development, Romania, factor analysis, cluster analysis, regional development

**JEL Classification:** R1

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**Introduction**

Within the most innovative activities (commonly described as science-based industries) a group of services called Knowledge-Intensive Business Services (KIBS) stands out (Rodriguez, 2013). The development of KIBS in recent decades can be interpreted as one of the major factors in a transition from an industrial economy into a knowledge-based one (Zieba, 2013). For a long time, much innovation research tended to concentrate on the manufacturing sector, in particular on high-tech industries, and technological innovation, while neither the service sector nor non-technological innovations were considered in detail. However, this situation changed drastically: both in science and policy, as interest in KIBS in particular grew (Miles et al., 1995). The perception of services shifted from adapters of innovation stemming from the manufacturing sector to important players in the innovation process, not only as individual innovating actors, but also as spurs to the innovativeness of their clients (Muller and Doloreux 2009).

The general scientific aims of the research in this paper were various. On the one hand the authors wanted to gain information about the relationship between the indicators with special regards to the tourism indices and the KIBS related variables, and to determine their position among the different development indicators. The authors also attempted to assign observations to groups (in this particular case, to Romanian counties and Bucharest), in which the observations are similar to one another, with respect to variables of interest. To achieve these goals, factor and cluster analysis were used.

This paper offers a review of the scientific literature about KIBS and its components and relationships. It uses different methodologies to describe the results of KIBS-related local units per 1000 inhabitants and incorporates them into a territorially-detailed investigation with a static view. The results of the correlation matrix and the factor analysis demonstrate an especially strong relationship with several factors. The paper concludes with a final summary.

## 1. Literature review

### 1.1 KIBS in general

KIBS have various definitions. Toivonen (2004) defined KIBS as those services provided by businesses to other businesses or to the public sector in which expertise plays an especially important role. Pardos, Gomex-Loscos and Rubiera-Morollon (2007) stated that KIBS are personalized services that offer a relatively diversified range with high quality provision. Koch and Strotmann (2008) think of KIBS as highly application-oriented services (in which) tacit knowledge plays an important role. Consoli and Elche-Hortelano (2010) refer to them as intermediary firms which specialise in knowledge screening, assessment and evaluation, and trading in professional consultancy services.

Knowledge-intensive business services build a subcategory of Knowledge-Intensive Services (KIS) that Strambach (2008, p. 156) describes by adding the following two points:

- Cumulative learning arises from in-depth interaction between supplier and user (Muller-Zenker, 2001)
- The activity of consulting, i.e. "process of problem solving in which KIBs adapt their expertise and expert knowledge to the need of the client".

The external providers are usually KIBS but, increasingly, Research and Technology Organisations (RTOs) compete with KIBS as a result of changes in funding systems (Hales, 2001; Dugas, 2012). Excellent examples of RTOs are Technalia in the Basque Country, VTT in the Uusima region in Finland or EURAC Research in South-Tirol, Italy. KISA are the Knowledge-Intensive Service Activities that firms undertake in conjunction with external or internal experts to build capability in the multiple areas needed for sustained innovative activity (Martinez-Fernandez, 1998). The demand for knowledge-intensive services seems to increase with the efforts of European economies to maintain their competitive positions through their development into knowledge-based economies.

This is reflected in favourable employment figures. While total employment in the EU grew annually by 1.4 % on average, between 2002 and 2007, KIS employment grew by 3.8 %. Since then, there has been a moderate growth with 0,4% in total and 1,5% in KIBS employment. Hence, without KIS, the annual employment growth in European economies would have been only 0.3 % during this period. The high growth rates of KIS over the previous years were primarily demand-driven. A set of interrelated factors can be identified to explain this trend (Dachs, 2009).

Sectoral taxonomies have proposed several categories of service industries but all classify a common group of services, called knowledge-Intensive Business Services (KIBS), as major innovators. KIBS are more and more frequently seen as key agents in knowledge production, diffusion and use (Rodriguez, 2013). It is common to distinguish between T-KIBS, (those with high use of scientific and technological knowledge - R&D services, engineering services, computer services, etc.), and P-KIBS, who are more traditional professional services - legal, accountancy, and many management consultancy and marketing services (Miles et al., 1995; Zieba, 2013). These services either supply products which are themselves primary sources of information and knowledge, or use their specialist knowledge to produce services which facilitate their clients' own activities.

### 1.2 KIBS and Economy

Many researchers stress the close relationship between KIBS and the levels of innovation and performance of the entire economy (Hipp, 1999; Tomlinson, 1999; Aslesen and Isaksen, 2007, Khademi-Vidra, 2014). It is an increasingly common belief that KIBS not only perform innovation activities in the service of the manufacturing sector, but they are also "bridges of knowledge" or "innovation bridges", connecting the manufacturing sector, science and customers (Czarnitzki and Spielkamp, 2003). Knowledge-intensive services are gaining importance in the economies of all developed countries. In Switzerland, in the UK, and in the USA KIBS contribute 25% of GDP growth while in other developed Western European Economies (Ireland, France, Belgium, Germany) and in Australia, KIBS account for more than 20% (ConferenceBoard, 2015). KIBS are largely based on professional knowledge (expertise) associated with a specialized field or discipline, and provide intermediate (not final) products (den Hertog, 2000). One possible indicator for describing the knowledge-intensity of KIBS activities is the structure of the formal education of the employees working for such companies (Miles, 2005). It is not surprising that KIBS employment is continuously rising in the EU states (Table no. 1.)

**Table no. 1: KIBS employment in the EU states (Percentage share of industrial employment)**

| EU member state | KIBS employment | | | |
|---|---|---|---|---|
| Year | 2008 | 2009 | 2010 | 2013 |
| Belgium | 5,37 | 5,50 | 6,15 | 6,20 |
| Bulgaria | 2,70 | 3,21 | 3,75 | 3,78 |
| Czech Republic | 5,19 | 5,39 | 5,54 | 5,71 |
| Denmark | 6,36 | 5,88 | 5,11 | 5,82 |
| Germany | 6,00 | 6,03 | 6,21 | 6,52 |
| Estonia | 4,51 | 4,64 | 4,92 | 4,90 |
| Ireland | 6,39 | 4,74 | 4,97 | 5,12 |
| Greece | 5,15 | 5,23 | 5,24 | 5,01 |
| Spain | 5,71 | 5,94 | 5,96 | 5,96 |
| France | 6,01 | 6,03 | 6,13 | 6,29 |
| Italy | 5,94 | 6,06 | 6,12 | 6,10 |
| Cyprus | 4,09 | 4,07 | 5,95 | 5,75 |
| Latvia | 3,44 | 3,63 | 3,78 | 3,81 |
| Lithuania | 3,25 | 3,43 | 3,66 | 3,81 |
| Luxembourg | 10,70 | 10,79 | 10,98 | 11,20 |
| Hungary | 6,00 | 6,01 | 6,32 | 6,44 |
| Netherlands | 9,28 | 8,69 | 8,47 | 8,69 |
| Austria | 5,57 | 5,88 | 6,05 | 6,42 |
| Poland | 3,05 | 3,41 | 3,47 | 3,88 |
| Portugal | 4,74 | 4,88 | 5,05 | 5,12 |
| Romania | 2,27 | 2,50 | 2,49 | 2,62 |
| Slovenia | 5,17 | 5,53 | 5,85 | 6,01 |
| Slovakia | 2,69 | 2,82 | 5,15 | 5,30 |
| Finland | 5,65 | 5,78 | 5,87 | 6,21 |
| Sweden | 7,36 | 7,47 | 7,72 | 7,90 |
| United Kingdom | 8,33 | 8,86 | 8,06 | 8,56 |

Source: Developed after Schicke et al, 2012; Schnable and Zenker, 2013

KIBS are characterized using four indicators: a high degree of knowledge, a high degree of technology, a high degree of interaction, and a high degree of innovation. KIBS are "responsible for the combination of knowledge from different sources and for the distribution of knowledge itself" (Hipp and Grupp, 2005, p. 518). All of the above conditions require the employment of the highest level of human resources and accessible technology. Personnel qualification is considered a key element in the service innovation process (Gallouj and Weindstein, 1997). Consumption of the KIBS service usually brings about the improvement of the client company's intellectual capital. KIBS have key characteristics instrumental to the rise of a knowledge-based economy (a fact which has a direct impact on tourism companies), and constitute one of the most dynamic elements of the service sector in many developed countries (Strambach, 2001).

Compared to technologically-oriented processes in the manufacturing sector, innovation in KI(B)S is shaped by certain specifics (Burr, 2007; Tether and Hipp, 2000): the human

factor is of high importance, production and consumption are a simultaneous process, service innovations are of an intangible nature, and service innovations are characterized by a strong connectivity to customers. The nature of innovation within KI(B)S is often project-based, ad hoc, and interactive, i.e. the human factor is the key factor. The high importance of human capital stems from the fact that knowledge is "embodied in people and embedded in networks" (Strambach, 2008), These findings are also typical for tourism. Tourism companies need to compete with others in the market on new ideas and products (services), as well as on price. Solutions that meet these criteria can be offered by suppliers of KIBS (Borodako, 2012).

To understand the operation of KIBS in tourism, it is necessary to consider the regional context in which they operate and their function in the regional and extra-regional divisions of labour, as well as their impact on the renewal of regional technoeconomic paths. Innovation research during the past decades has demonstrated that regional factors and endowments may have an impact on the innovative activities of business firms, and that region-specific innovation modes can be detected (Commission of the European Communities 2007; European Commission 2001). Specifically referring to knowledge-intensive service firms, a high concentration of KI(B)S firms are expected in core regions and urban centres, while peripheral regions often lack a wide variety of specialized KI(B)S (Strambach, 2001). In addition, further concentration tendencies are expected. During the past decade, the spatial concentration of KI(B)S rose and further concentration appears likely (Jennequin, 2008). Wood (2005) found in a European study that regional patterns of KI(B)S differ, depending on the KI(B)S activity. Core city regions exhibit concentrations of marketing, advertising and service companies specialized in financial business. Computer services are also concentrated in prosperous regions.

Tourism is one KIBS which could appear and operate in backward areas if the conditions meet the necessary requirements. While KI(B)S in core regions function as bridges, KI(B)S in peripheral regions are embedded within their environment (Koschatzky, 1999). In Romania, KIBS also tend to play an important role in the economy. According to the European Commission (2013), KIBS employment is roughly 2,5 % and they contribute approximately 10% to the GDP of Romania. Unfortunately, empirical research is not currently available regarding the importance of KIBS in Romania but comparisons can offer potential conclusions regarding this. Rodriguez (2012) stated that, together with core and urban regions in central and southern regions, the New Member States seem to have attracted either local or foreign KIBS firms that contribute to employment at a level comparable to that of other states. Particular examples are the regions of Prague, Bucharest, Bratislava and Budapest (Rogriguez, 2013). She also mentioned that the share of KIBS in total intermediate consumption grew in all the EU countries with the exceptions of Greece and Slovakia. This supports the arguments expressed in the introduction regarding the rising importance of services, and specifically of KIBS, within the production systems. Related to the share of KIBS in total intermediate consumption, Romania exhibited the lowest participation. With only 1.82% of total intermediates, Romania experienced the largest growth rate over the period, growing at almost twice the rate of Ireland, the second highest rate in the study (Rodriguez, 2013). Comparing the three sectors of manufacturing, services and KIBS, it is clear that the R&D intensity of KIBS is substantially superior to the average R&D intensity of the service sector in all countries. The average R&D intensity of the manufacturing sector was superior to the R&D intensity of KIBS. However, Romania was medium-ranked in R&D intensity, clustered with Greece, Belgium, Slovakia, Slovenia

and Germany. There appears to be a weak connection between the Romanian KIBS sector and the rest of Romania's industries. The existence of weak linkages between the KIBS sector and the rest of industries, and, more specifically, of weak forward linkages could be a significant contributor to the "diffusion gap" of the country.

The research goals this paper were various, including both to gain information about the relationship between the involved indicators, with special regards to the tourism indices and the KIBS related variables, and to determine their position among the different development indicators. It also groups observations (of Romanian counties and Bucharest), in which the observations are similar to one another, with respect to variables of interest.

### 1.3 KIBS in tourism

Bodoranko extended the classification of KIBS to include professional services to tourism companies hosting or organizing events as part of business meetings (business travel). The two most important of these are event management services and technological event support. Both are tourism industry specific and largely related to business travel. The literature emphasizes the strong relationship existing between KIBS and their customers in terms of innovation process and knowledge creation (Bettiol et al, 2011). Marketing KIBS include Market research, Advertising, Research and experimental development in social sciences and humanities. Enterprise KIBS include Legal services, Accounting and tax advisory services, Management advisory and Public Relations services, Temporary employment agencies, Event management services, and other recruitment services. Technical KIBS include architectural services, technical testing and analysis, IT and programming services, technological (A/V) event support, research and experimental development in natural sciences and engineering, and engineering (Borodako et al., 2015)

Some sectors are NOT, in general, KIBS, though there are likely to be some KIBS firms present in many of these. They are either knowledge-intensive (health, education) or business-related (Miles, 2005) Specialised financial services are often borderline cases. Some major examples include; health/medical services, postal services, as well as consumer financial and real estate services.

## 2. Research methodology

### 2.1 Research question and objectives

In the current analysis, one of the most important objectives was to discover the relationship among the indicators with special regards to the tourism indices and the KIBS related variables. An attempt was made to determine their position among the different development indicators. By using a geographical approach, the issue of territorial disparities and the spatial pattern received greater emphasis.

On the basis of the literature, some hypotheses were developed. It could be assumed that KIBS related indicators are in close relation to the indicators of higher education and economic activities (turnover or incomes). According to this hypothesis, KIBS would tend to display significant territorial concentration in Romania. This pattern was expected to significantly overlap other development indicators in a multivariate approach.

### 2.2 Description of methods and procedures

In order to map the complex territorial development levels in the Romanian counties (41 Nuts-3 units plus Bucharest), a database was created from the data provided by the Romanian National Institute of Statistics (INSSE, 2015). These data, often used in international and national comparative studies, reflect different elements of development. There are many multidimensional relations among the data, however, this research avoids indicators that are either calculable from each other or have direct connections with each other. The available database was delimited and the indicators selected were filtered with a focus on the input dataset using specific indicators from the factor and cluster analyses.

- 1; GDP per capita, Lei (real price for 2012)[†] - GDPCAPITA;
- 2; number of enterprises per 1000 inhabitants (2013) - ENTERPRISE;
- 3; per capita turnover from local units, 1000 Lei (real price for 2013)[**] - TURNOVER;
- 4; total expenditure per capita from research-development, Lei (real price for 2013) [**] - RESEARCH;
- 5; number of local units related to KIBS per 1000 inhabitants (2013)[***] - KIBS;
- 6; average monthly income per capita, Lei (real price for 2013)[**] - INCOME;
- 7; activity rate of labour resources, % (2013) - ACTIVITY;
- 8; rate of registered unemployment, % (2013) - UNEMP;
- 9; rate of urban population, % (2013) - URBAN;
- 10; migration (within country) balance per 1000 inhabitants (2013) - MIGRATION;
- 11; life expectancy at birth, year (2013) - LIFEEXP;
- 12; rate of population without completed primary school, % (2011) - INCOMP;
- 13; rate of population with university degree, % (2011) - DEGRUNI;
- 14; rate of population with access to sewage system, % (2013) - SEWAGE;
- 15; finished dwellings during 2013 for 10000 inhabitants - DWELLINGS;
- 16; number of personal cars per 1000 inhabitants (2013) - PERSCAR;
- 17; number of staying overnights per 1000 inhabitants (2013) - NIGHTS;
- 18; number of tourist accommodations per 1000 inhabitants (2013) - ACCOM;
- 19; number of tourists arrived per 1000 inhabitants (2013) - TOURIST.

[†] 1 Euro = 4.4291 RON in December 30, 2012 (BNR, 2012)
[**] 1 Euro = 4.4639 RON in December 30, 2013 (BNR, 2013)
[***] The following categories were selected according to the broader definition of KIBS (described previously) by the activity of active local units of national economy at level of CANE Rev.2 divisions: 58-64, 66, 68-74, 80, 82, 85 (for more details see INSSE, 2015).

These indicators are hereafter referred to by their acronyms.

In these specific analyses, a homogenous database was required, so the rest of the indicators were collected for one static year – 2013 (INSSE, 2015). Some variables were available only from the previous years (e.g. GDP or census data). The available datasets provided only a limited possibility to detect KIBS-related activities from a territorial point of view (the number and ratio of the local units were available in this form).

***Factor analysis*** is a popular method to achieve data reduction from numerous variables. The method is based on the correlation and regression calculations and on probability theory. (On steps of calculations, see inter alia Tryfos, 1998; Babbie, 2007; Demeter and Radics, 2010). The calculation results in new variables called compressed factors from the grouped original variables. The within-factor correlations tend to be maximised while the correlation coefficients tend to be minimized between the factors. The method provides (basically) non-correlating values for the individual factors, which themselves can be considered as complex indicators. The issues of KIBS were analysed by the methodology of factor analysis and principal components (Shearmur and Doloreux, 2012). The most important objectives of this factor analysis were to gain information about the relationship between the involved indicators (listed above), with special regards to the tourism indices and the KIBS related variables (Schnable and Zenker, 2013), and to determine their position among the different development indicators.

During the factor analysis, some of the indicators were filtered out (e.g. rate of population with secondary education) or were logarithmically transformed to fit an appropriate distribution for the calculations. The standardized data were processed by the principal component method with Varimax rotation regarded as the most commonly used procedure (Shearmur and Doloreux, 2012). IBM SPSS Statistics version 21 was used.

***Cluster analysis*** was applied in order to provide a multivariate investigation of the territorial dataset. The main objective of the cluster analysis was to assign observations to groups (in this particular case, to Romanian counties and Bucharest) in which the observations are similar to one another, with respect to variables of interest. The observed homogeneous groups themselves stand apart from each other (Tryfos, 1998; Jain, Murty and Flynn, 1999; Mooi and Sarstedt, 2011). Some precedents could be found for the investigation of KIBS by the methodology of cluster analysis (Corrocher, Cusmano and Morrison, 2009; Bolisani, Paiola and Scarso, 2014).

Cluster analysis was also carried out using the IBM SPSS Statistics version 21 programme. A hierarchical clustering procedure was applied using the Ward method and squared Euclidean distance measurement by standardized variables.

## 3. Results and discussion

The knowledge-intensive business services represent significant territorial inequalities in Romania on the NUTS-3 level. The chosen KIBS-related indicator provides a sectoral approach that reflects the major within-country disparities as well (Figure no.1.). Thirty-six percent of the KIBS-related local units were concentrated in Bucharest while only six more counties; Cluj, Ilfov, Timiș, Brașov, Constanța and Sibiu, showed above-average values for the number of local units related to KIBS per 1000 inhabitants. This gives a clear

demonstration the territorial pattern of KIBS with visible correlation with the per capita value of gross domestic product.

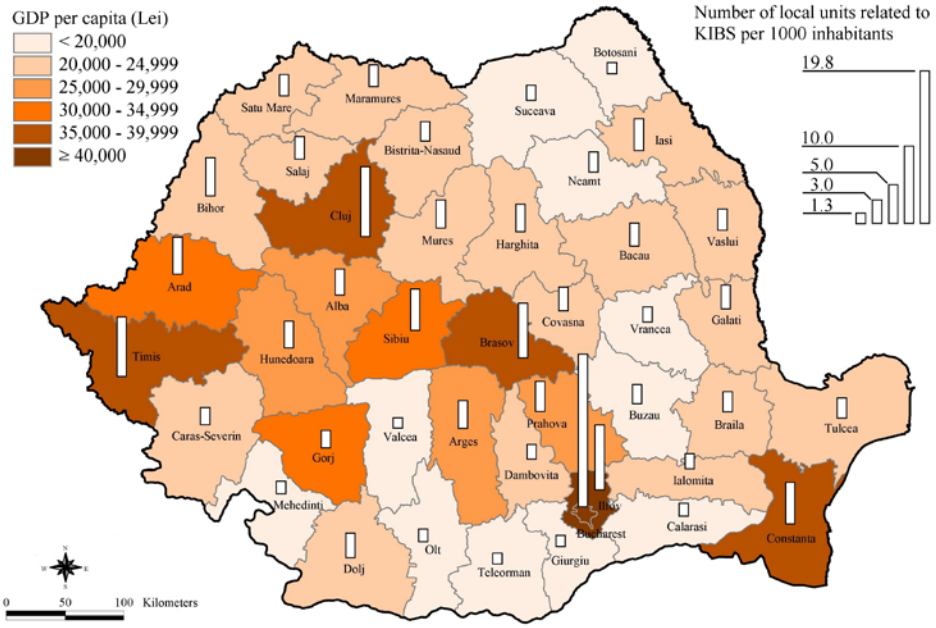


**Figure no. 1: The GDP per capita (Lei) and the number of local units related to KIBS per 1000 inhabitants in the Romanian counties in 2013**

*Source: Calculated and edited by the database from Romanian National Institute of Statistics*

The factor analysis was carried out using the previously listed indicators and methodology. The results were further assessed using KMO-Bartlett's test. The result of 0.854 is interpreted as 'meritorious' according to Hutcheson and Sofroniou (1999), however, it should be noted that the number of samples is relatively small, due to the territorial aggregation. The correlation matrix of the collected indicators predicted the results of the factor analysis as shown in Table no. 2. Due to the limited extent of the study, the matrix contains only the correlation coefficients calculated for the KIBS-related variable. The values clearly represent the extraordinarily strong correlation between the KIBS-related variable and the number of enterprises, the GDP, and the level of turnover per capita values. The influence of educational level and quality workforce was also demonstrated by the high value of correlation between the KIBS-related variable and ratio of population (over the age 7 years) with university degree. The correlation coefficient was significant with all of the investigated indicators.

**Table no. 2: The correlation coefficients of the KIBS related variable and the investigated indicators**

| Indicators | KIBS |
|---|---|
| ENTERPRISE | 0.952 |
| DEGRUNI | 0.937 |
| GDPCAPITA | 0.913 |
| TURNOVER | 0.898 |
| PERSCAR | 0.767 |
| URBAN | 0.753 |
| RESEARCH | 0.747 |
| INCOME | 0.746 |
| TOURIST | 0.712 |
| SEWAGE | 0.683 |
| MIGRATION | 0.676 |
| ACTIVITY | 0.611 |
| NIGHTS | 0.535 |
| DWELLINGS | 0.443 |
| ACCOM | 0.431 |
| LIFEEXP | 0.389 |
| UNEMP | -0.585 |
| INCOMP | -0.690 |

*Source: calculated and edited based on the database from Romanian National Institute of Statistics (the description of the acronyms is in the text)*

These four components, described in Table no. 3, explained 82.84% of the total variance and were named after their most characteristic indicators.

*The first component (or dimension)* ('economic prosperity') included 10 variables (indicators). Some of them represented significant correlations with the first factor. The results tend to confirm the general interdependence of correlations between economic and social indicators and that a large number of companies and a high activity rate tend to correlate with the larger level of gross domestic product per capita. The KIBS-related variable was classified as part of this factor along with the previously-mentioned indicators of education. Variables indicating the level of urbanization and the developed infrastructure are also part of this factor.

Economic welfare clearly correlates with the urbanization level and infrastructural development, demonstrated by the rate of population with access to a sewage system.

*The second component* ('material enrichment') was based on six indicators. The number of dwellings built (and finished) during 2013 resulted in the strongest correlation coefficient, however, the temporal image of the construction sector is highly volatile and the results of the current analysis would have been different under other economic circumstances in different years. The sector was very dynamic before the financial crisis began in 2008 then declined rapidly due to the oversupply in the housing market. The level of average income and the per capita turnover from local units were classified into this component. The rate of unemployment also strengthens the material dimension of this component. The total expenditure per capita from research-development supports the argument for interdependence with the previously listed indicators.

**Table no. 3: Results of the Factor Analysis - the rotated component matrix of the indicators within the factor analysis**

| | Components (dimensions) | | | |
|---|---|---|---|---|
| | **1 'Economic prosperity'** | **2 'Material enrichment'** | **3 'Tourist attractiveness'** | **4 'Life expectancy'** |
| SEWAGE | **0.843** | 0.017 | 0.185 | 0.074 |
| PERSCAR | **0.838** | 0.141 | 0.385 | 0.111 |
| URBAN | **0.809** | 0.159 | 0.349 | -0.073 |
| DEGRUNI | **0.785** | 0.495 | 0.230 | 0.205 |
| GDPCAPITA | **0.743** | 0.536 | 0.199 | 0.130 |
| KIBS | **0.726** | 0.600 | 0.236 | 0.098 |
| ACTIVITY | **0.700** | 0.058 | 0.064 | 0.247 |
| ENTERPRISE | **0.693** | 0.579 | 0.274 | 0.050 |
| INCOMP | **-0.681** | -0.191 | -0.310 | -0.399 |
| DWELLINGS | -0.163 | **0.840** | 0.164 | 0.270 |
| RESEARCH | 0.400 | **0.672** | 0.084 | 0.375 |
| TURNOVER | 0.621 | **0.667** | 0.203 | 0.077 |
| INCOME | 0.573 | **0.637** | -0.169 | 0.193 |
| MIGRATION | 0.449 | **0.542** | 0.244 | -0.166 |
| UNEMP | -0.105 | **-0.726** | -0.347 | 0.262 |
| ACCOM | 0.184 | 0.122 | **0.939** | 0.100 |
| NIGHTS | 0.281 | 0.175 | **0.904** | 0.107 |
| TOURIST | 0.412 | 0.349 | **0.798** | 0.176 |
| LIFEEXP | 0.241 | 0.104 | 0.203 | **0.873** |

*Source: calculated and edited based on the database from Romanian National Institute of Statistics*

*The third component* 'tourist attractiveness' concentrated on only tourism indicators. In the light of the results, tourism cannot be considered as a typical development indicator, when distinguishing these indicators from the 'economic prosperity' component. The most important reasons for this phenomenon are the spatial inequalities and the significant concentration of tourism. The results of weighted centroid calculation also supported this characterization of tourist indicators (Bujdosó et al 2015). Tourism indicators did not represent unambiguous correlation with the KIBS-related indicator.

*The forth component* ('life expectancy') consisted of a single indicator, life expectancy at birth, and illustrates the differing character of this variable. While it displays a relationship with the indicators of economic welfare and well-being and educational levels, the environmental effects must also be included with the other factors.

### 3.1 Results of cluster analysis

The objective of the analysis was to create spatial clusters from the counties of Romania with the help of the multivariate clustering method. The best clustering results were provided by 5 clusters as shown in Figure no. 2.

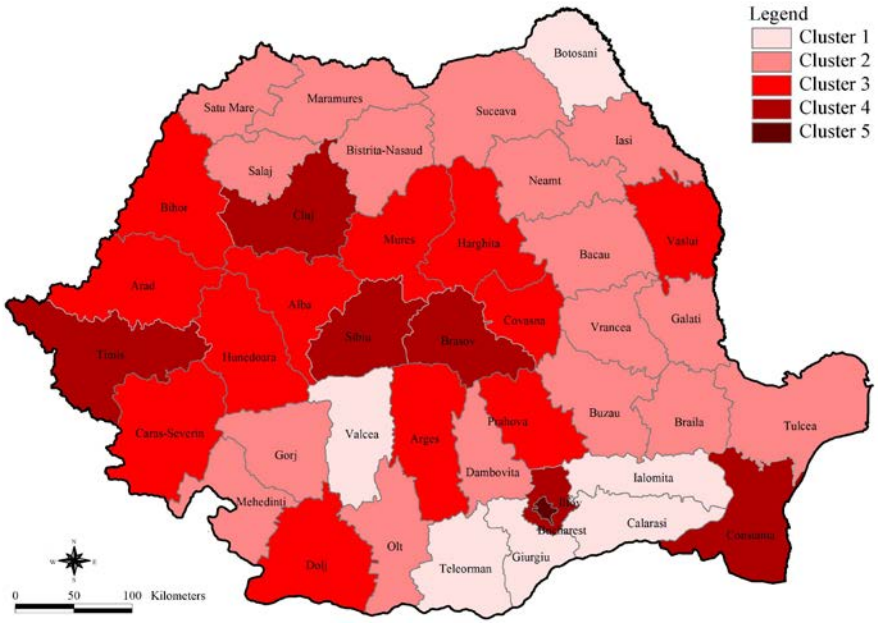


**Figure no. 2: Clusters of the Romanian counties by the cluster analysis**

*Source: calculated and edited based*
*on the database from Romanian National Institute of Statistics*

Major spatial disparities appeared within the cluster analysis. The first cluster included Botoşani, Călăraşi, Giurgiu, Ialomiţa, Teleorman and Vâlcea counties. These counties generally represented the worst average indicators among the clusters, including GDP per capita, or relative income level and the KIBS-related indicator.

The largest set of Romanian Nuts-3 units was grouped in Cluster 2. The counties in the cluster could be regarded as underdeveloped as well, but their average features demonstrate a slightly better economic position than the counties in the Cluster 1.

The third cluster covers the largest part of the central and western Nuts-2 regions. These territories are in a transitional state comparing to the first and second groups of counties. KIBS-related indicators represented a better average situation but they were still far from the leading counties from this respect.

Cluster 4 contains Braşov, Constanţa, Cluj, Ilfov, Sibiu and Timiş counties, while Cluster 5 includes only Bucharest with its exceptional development indicators.

The multivariate cluster analysis included not only the KIBS-related indicator, but demonstrated that the resulting clusters reflect the increasing presence of these local units as well as the growing level of regional development (expressed by the GDP per capita) of the aggregated values. Bucharest and the counties in the Cluster 4 concentrated almost 60 percent of the KIBS-related local units within Romania. The steadily increasing income level and the percentage of the population with a university degree also demonstrate the strong relationship between territorial development and higher educational levels. (table no. 4)

**Table no. 4: The rotated component matrix of the indicators within the factor analysis**

| Variables | Cluster 1 | Cluster 2 | Cluster 3 | Cluster 4 | Cluster 5 |
|---|---|---|---|---|---|
| GDPCAPITA | 16738 | 20957 | 25291 | 37652 | 76499 |
| KIBS | 1.48 | 2.57 | 3.61 | 7.21 | 19.80 |
| UNEMP | 4.72 | 3.75 | 4.11 | 2.29 | 1.50 |
| INCOME | 1234 | 1328 | 1370 | 1625 | 2304 |
| DEGRUNI | 7.10 | 10.65 | 12.95 | 18.11 | 33.66 |

*Source: calculated and edited based on the database from Romanian National Institute of Statistics*

## Conclusions

In this analysis, KIBS were expressed by one indicator containing the value of KIBS-related local units per 1000 inhabitants and incorporated into a territorially-detailed investigation with a static view. The correlation matrix and the factor analysis demonstrated an especially strong relationship with several factors, including the GDP per capita, the qualified workforce, the number of enterprises, and the turnover of local units. Factor analysis placed the KIBS-related indicator into the first component (dimension) named 'Economic prosperity' with different developmental and infrastructural indicators.

The KIBS-related activities represent significant spatial concentration in the urban centres, especially in Bucharest. The concentration of KIBS-related local units were significant in Brașov, Cluj, Constanța, Ilfov, Sibiu and Timiș counties (these counties and Bucharest contained almost 60 percent of the KIBS-related local units in Romania in 2013). This territorial pattern completely overlapped the results of the cluster analysis, strengthening those results. The multivariate methods clearly demonstrated the strong correlation among the development indicators that predicts the significant spatial disparities from the respect of KIBS in Romania.

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